

# STEERING GEAR MS30-60.1A

Technical Operation Documentation  
TR-01/71128-00.00

Valid for ship: SAR 3000 / 3



**HYDROSTER Ltd.**

Na Ostrowiu 1 St.  
80-958 GDAŃSK, POLAND  
tel. (+48 58) 307 12 90, fax (+48 58) 307 12 92,  
e-mail: [office@hydroster.com.pl](mailto:office@hydroster.com.pl)



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## 1. Technical description.

The steering gear is designed for SAR vessel to drive a rudder via two hydraulic cylinders. Ship is equipped with two identical units.

### 1.1 Technical characteristics of steering gear units.

It is a 2 cylinder, piston type steering gear. It fulfils all requirements of SOLAS 1974 Convention with later amendments. The steering gear is adapted to mate with electronic remote control system and designed to co-operate with directional control valves ON-OFF type.

The steering gear hydraulic diagram is shown on the drawing [HH-01/71128-00.00](#) (att. 1) diagram and its sub-assemblies are specified in the “Schedule of Elements” [WE-01/71128-00.00](#) (att. 2). Main characteristics and settings are given in “Technical Data” [TD-01/71128-00.00](#) (att. 3).

The electric drive and signaling systems are described in the electric part “Technical - Operation Documentation of Steering Gear with Equipment” - WR - 494.

#### 1.1.1 Power unit ZS 30-60-1.

The unit consists of:

- tiller acc. to dwg. [62131-00.00/00-00](#) (att. 4), schedule [WE-01/62131-00.00](#) (att. 5)
- 2 single-rod hydraulic cylinders acc. to dwg. [21162-00.00/00-00](#) (att.6), schedule [WE-01/21162-00.00](#) (att. 7)
- 2 valve blocks, one for each cylinder acc. to dwg. [44219-00.00/00-00](#) (att. 8), schedule [WE-01/44219-00.00](#) (att. 9)
- cylinder holder acc. to dwg. [27131-10.00/00-00](#) (att. 10)

Power unit refers to dwg. [27131-00.00/00-00](#) (att. 11) with schedule [WE-01/27131-00.00](#) (att. 12). The reciprocating movements of hydraulic cylinder piston rod is turned into rotation motion of tiller via lug with barrel bearing and bolt deposited in the tiller arms.

The bottom of each cylinder is mounted and self-aligning ball bearing, through which the rear connecting pin cylinder with a handle of cylinders. This handle is attached to the steering gear foundation of the unit by fitting bolts.

Each of hydraulic cylinders acc. to dwg. [21162-00.00/00.00](#) (att. 6) and Schedule of Elements [WE-01/21162-00.00](#) (att. 7) is coupled with safety valve block BZ-KP40-1.0/1016 acc. to drawing [44219-00.00/00.00](#) (att. 8) and schedule [WE-01/44219-00.00](#) (att. 9). The setting pressure of those valves is given in Technical Data [TD-01/71128-00.00](#) (att. 3). Blocks

protect the cylinders from high pressures in case of big forces acting to the rudder blade. Moreover 2 shut-off valves are mounted in the block C13, C14, (C23, C24) acc. to dwg. [HH-01/71128-00.00](#) (att. 1) to enable emergency opening in special cases. All is given in the exploitation instruction of steering gear. Normally the valves are sealed and closed.

Shut-off valves are screwed into the body of each hydraulic cylinder. They enable to separate the cylinder from the hydraulic system of steering gear. Those valves are normally open and sealed with lead in such position. They can be closed only in special cases provided in the exploitation instruction of steering gear, e.g. when there is a necessity to block the rudder.

All possible states corresponding to mentioned valves can be found on Information Plate acc. to dwg. [71128-00.00/01-00](#) (att. 13).

### 1.1.2 Drive units ZNZ2-8/400-50/100LX4/100.

The main elements of drive units - dwg. [35165-00.00/00-00](#) (att. 14), schedule [WE-01/35165-00.00](#) (att. 15) are:

- 2 pump units ZPZ1-8/400-50/100LX4 with gear pumps acc. to dwg [32132-00.00/00-00](#) (att. 16), [WE-01/32132-00.00](#) (att. 17)
- 2 valve blocks BZ-KP39-2.0/0616, dwg. [44218-00.00/00-01](#) (att.18), [WE-01/44218-00.00/00-01](#) (att. 19) with directional control valves ON-OFF type
- circulating tank with two chambers, with equipment

Pump unit ZPZ1-8/400-50/100LX4, dwg [32132-00.00/00-00](#) (att. 16) is mouted on a circulating tank cover. It comprises of a gear pump is coupled with an electric motor by an elastic shaft. The pump is assebled on the motor by a flage link.

Gear pump takes oil directly from the circulating tank and presses it directly to the valve block BZ-KP39-2.0/0616 (att. 18).

Direction of oil flow is controlled by the solenoid directional control valve mating with remote control system. Valves are also equipped with levers for a local control.

Valve blocks BZ-KP39-2.0/0616 acc. to drawing [44218-00.00/00-01](#) (att. 18) are mounted on each of the drive units. Its valves and other components are specified in the Schedule of Elements [WE-01/44218-00.01](#) (att. 19). In case of a single failure to one of the main drive units of steering gear, system will allow to split units using shut-off ball valves.

Each pump has got its own circulating tank of hydraulic oil. Tank is equipped with the following elements:

- return filter of oil
- oil level sensor
- oil level indicator (bayonet)

- thermometer
- T socket, for cylinder compensating line connection

Low oil level in tank is signaled by the level sensor. The failure occurs by lowering oil level in the tank. At the same time when the signal of low oil level occurs, working drive unit should be turned off immediately to prevent pump damage. If oil loss is caused by pipe connection with the power unit or cylinder failure then the second drive unit should be turned on. In this situation steering gear control remains. In other case pump units should be separated by shut-off valves connecting both valve blocks.

ATTENTION: Due exploitation period closing valves on compensation links on the circulation tank (socket T1 and T2) is forbidden.

The tank venting is held by the inlet filter cap. The return filter is equipped with optical and electrical sensor used for signaling its contamination.

### 1.1.3 Spare tank.

The spare tank includes necessary oil quantity for filling at least the half of hydraulic system of steering gear together with the circulating tanks. Tank is filled-up by inlet filters, which can be connected by pipeline with the inlet onboard the ship. To fill the system by oil from the spare tank, a hand vane pump is used, which hangs on the body of spare tank.

For checking oil level in tank the oil level indicator bayonet type is used, which is installed in the upper tank cover. The drain cock is plugged with a seal to enable the casual oil draining from the tank.

### 1.1.4 Plates and instruction tables.

There are provided following plates and instruction tables:

- 3 tables [71128-00.00/01-00](#) (att. 13), one for wheelhouse, two for steering gear compartments to be placed near the drive unit. Tables contain information about possible ways of steering gear control
- table acc. to dwg. [71711-03.07/02-00](#) (att. 20) to be placed in wheelhouse
- table acc. to dwg. [71711-03.07/03-00](#) (att. 21) to be placed in wheelhouse

### 1.1.5 Pipe fittings.

Pipe connections to be carried out with dimensions given in dwg. [HH-01/71128-00.00](#) (att. 1). Pipe material acc. to E355 material group. Pipes fittings are placed and sealed on pipes by cutting rings. Ends of fittings are screwed into elements of hydraulics and sealed by sealing ring of fitting body.

## 1.2 Way of operation.

The hydraulic system of steering gear consists of 2 similar and independent systems, which normally are coupled. Main units are equipped with gear pump driven by el. motors. In case of a single failure in one circuit they have to be manually separated. After separation of damaged system, the steering gear is still efficient for the further work.

The detailed technical description of operation and separation instructions are given in Emergency instruction table [71128-00.00/01-00](#) (att. 13).

Gear pumps, placed inside the circulating tank sucks-in oil and presses it to relevant valves blocks, fitted on the tank cover. In the meantime, electronically controlled directional control valve changes over to open position, thus enabling flow from the main pump to cylinder chambers. The steering gear execute the required turn of tiller. It is also possible to change over directional control valve slider position by hand. It will cause the same effect.

The rudder deflection stops when signal in directional valves disappears and oil stops feeding cylinders.

Operation possibilities of steering gear are given in instruction table [71128-00.00/01-00](#) (att. 13).

## 1.3 Technical receipt.

The technical receipt of steering gear is carried out by the producer's Quality Control Department and by the Classification Society.

Relevant documents are delivered together with the product.

## 1.4 Ambient conditions.

Ambient temperature for steering gear, switched-off from the exploitation and during the operation, is given in the Technical Data (att.3).

## 2. Exploitation and service instructions.

### 2.1 Hydraulic oils.

For filling the hydraulic system, high quality hydraulic mineral oils free from mechanical, chemical, water and of the following characteristics should be used:

- kinematical viscosity  $\nu = 46 \text{ mm}^2/\text{s}$  at  $40 \text{ }^\circ\text{C}$
- viscosity index not less than 95
- oil purity class: 9-10 acc. to NAS 1638; 6 acc. to SAE, ASTM, AIA; 18/15 acc. to ISO 4406
- filtration accuracy  $\beta_{20} \geq 100$  ( $\delta_{\text{nom}} = 10 \text{ }\mu\text{m}$ )

Hydraulic capacity of steering gear is given in the (att.3).

Recommended oils acc. to the table below.

Producer	Hydraulic oil	
	Recommended oils	Acceptable oils
RAFINERIA GDAŃSKA	L-HV46	L-HV68
SHELL	TELLUS OIL T46 TELLUS OIL 46	TELLUS OIL T68 TELLUS OIL 68
CASTROL	HYSPIN AWH46	HYSPIN AWH68
ANTAR	VISGA 46	VISGA 68
EXON MARINE	UNIVIS N46	UNIVIS N68 NUTO H68
MOBIL	DTE15M	DTE16M
CHEVRON	MECHNISM LPS46	MECHNISM LPS68
BRITISH PETROLUM	BP ENERGOL SHF100	BP ENERGOL SHF150
TEXACO	RANDO OIL C	RANDO OIL HD 68 RANDO OIL HD CZ

## 2.2 Filling of the hydraulic system of the steering gear with oil and commissioning.

That procedure concerns filling the steering gear for the first time, after repairs, inspection and oil exchanging.

- check cleanness of tanks and pipes. It should correspond with class of oil cleanness given in item 2.1. Special attention should be paid on cleanness of circulating tanks and suction pipes
- fill the spare tank by clean fresh oil
- fill circulating tanks by means of hand pump of spare tank
- open the shut-off valves on drive units
- open shut-off valves S1, S2 and T at cylinders

- open release shut-off valves C11-C14, C21-C24 and plugs Za, Zb, Zt in safety valve blocks
- check directions of electric motor rotations. During checking electric motors vans shields should removed. Turn on the motor for a very short time - max. 0,5 sec. After checking, vans shields should be put on motors again
- turn on one pump so oil will flow-out by venting valves. Close venting valves when air is out
- repeat all steps for the second pump

Not observing the above recommendations will cause the pump destruction!

After all procedure fill up the oil in the circuit. Correctly vented hydraulic circuit results in smooth motion of the cylinder during the steering gear operation.

## 2.3 Rinsing of the system.

The hydraulic system of the steering gear is rinsed at the producer before it starts. It is recommended to rinse the system once more at commissioning on the ship and after each oil exchange. For rinsing oil and technological filter, fulfilling the requirements of it. 2.1 should be used. Rinsing should be carried out separately for each pump and for each hydraulic cylinder.

Preliminary operations and rinsing:

- bring the steering gear to one of extreme positions
- close valves S1, S2
- demount the valve block from the cylinder together with pipe pos. 21 acc. to dwg. [27131-00.00/00-00](#)
- plug free outlet of a tee pos. 18
- screw-out the plug from the front probe of the cylinder
- connect technological filter with flexible pipes to free cylinder sockets (threads M22x1,5 acc. to DIN 3852)
- steer-up with solenoid control valve
- turn on the pump for about 60 min keeping the oil flow direction
- move the piston into opposite utmost location
- turn off the pump
- shift flexible pipes to keep right oil flow direction through the filter
- change the oil flow direction with the solenoid control valve
- repeat rinsing with the same pump
- mount the element which were taken down before

- vent rinsed part of the steering gear

Rinsing procedure is sufficient if the technological filter does not show contamination.

Pay attention on the direction of technological filters connection.

Following in the same way, rinse the second hydraulic cylinder and the second part of hydraulic system of steering gear by the second pump while valves S1, S2 are closed.

Connection scheme is shown in dwg. [DR-10/71128-00.00](#) (att. 22).

## 2.4 Turning-on and -off of the steering gear.

Turning on the steering gear for the normal operation depends on turning on 1 or 2 electric motors. Details are given in the electric part.

Turning off the steering gear depends on turning off both electric motors.

## 2.5 Drive and control of the steering gear and rudder blocking.

Drive and control are shown on the diagram in the table (next page). Possibilities of steering gear operation and position of valves are shown in Instruction Table (att. 13) in the wheelhouse and in the steering gear compartment.

Drive and control can be also found in the electric part.

### 2.5.1 Basic operation.

Single pump works with both hydraulic cylinders. Pumps should be switched over every 24 hours.

### 2.5.2 Emergency operation.

One of the pumps presses the oil to belonging cylinder. Second cylinder shuts-off automatically, by-pass valves C\_3, C\_4 must be opened. During reverse movement of the piston, torque of the steering gear is reduced by 2/3 while piston speed increases three times. During this mode of operation, the speed of the ship should be decreased and nominal pressure in the circuit  $p_n$  should not be exceeded.

In case of single failure broken unit is automatically cut-off and the steering gear remains in operation by second drive unit.

Steering		Drive	
Steering mode	Control	Working units pump	Working cylinders
<b>Remotely from wheelhouse</b>	<b>Follow-up ( FU)</b>	<b>1 (notice 2)</b>	<b>2</b>
			1
	<b>Autopilot</b>	<b>1 (notice 2)</b>	<b>2</b>
			1
	Non-follow-up (NFU) (notice 3)	1	1
			2
<b>Locally, by lever</b>	Non-follow-up (NFU) (notice 3)	1	2
			1
<p>Notice</p> <ol style="list-style-type: none"> <li>1. Bolded text and lines - recommended way of steering.</li> <li>2. Pumps should be switched-over every 24 hours.</li> <li>3. When non follow-up is applied, uncontrolled steering gear morion may occur. It is typical condition caused by water thrust on the rudder blade and by internal leakages in the hydraulic circuit. During follow-up control steering gear is automatically kept in desired position.</li> </ol>			

### 2.5.3 Rudder blocking.

#### 2.5.2.1 Stopping the rudder during anchoring period.

When both pumps are turned off, the rudder is stopped on the first given position. Due to very strong water thrusts influence on the rudder (storm, water currents), it can be displaced in uncontrolled way.

It is a normal effect caused by an interial leakage in the hydraulic system as the result of external overload.

In order to prevent that situation one pump should be turned on in the follow-up control mode. Every 24 hours working pump should be switched-over with another and the rudder should be put over from side to side.

## 2.5.2.2 Constant rudder blocking.

If it is necessary, constant rudder blocking can be done by turning off the pumps and by closing shut-off valves of all hydraulic cylinders.

## 2.6 Signaling of the steering gear work modes.

Signalization of steering gear operation is described in the electric part documentation.

## 2.7 Control of the steering gear work.

The control of steering gear during operation depends on the observation of signaling or failure.

Pressure gauges, installed on the steering gear, are to be used for periodical checking of control pressure and should be disconnected during the normal exploitation of steering gear.

## 2.8 Adjustment.

During normal exploitation adjustment procedure is not necessary. The adjustment of steering gear is made during commissioning and onboard installation set up. It might be necessary to adjust it after repairs - see point 4.

## 2.9 Exploitation with regard to safety rules.

The exploitation of steering gear does not require using special safety means. There are obliged general safety rules concerning exploitation of hydraulic and electric units. However, any manipulations in steering gear and its units, not concerned with normal exploitation, are forbidden.

In case of works applied to remote control system and electric motor of steering gear, supply system should be switched-off.

During works when the steering gear is switched-on, the attention should be paid on the rotary motion of the tiller.

## 2.10 Troubleshooting.

No.	MALFUNCTION	CAUSE
1.	Stroke work of steering gear. Noise in pipelines.	– the hydraulic system is aerated
2.	Pump works and steering gear does not deflect rudder at local and remote control.	– by-pass valve of cylinder is open – shut- off valve of cylinder is closed – safety valve of cylinder or pump is open or damaged – main pump is damaged
3.	Longer times of rudder putting over than given in the characteristics at simultaneous impossibility of obtaining pressure $P_{max}$ .	– sealing of cylinder piston is damaged – main pump is damaged
4.	Difference between required angle and obtained on steering gear is greater than $3^\circ$ in the whole range of rudder deflection at follow-up control mode.	– electronic remote control system is damaged – feedback coupling is wrongly adjusted
5.	Lack of reaction of steering gear for remote control. Steering gear operates correctly at local control.	– electronic remote control system is damaged or lack of electric connections

## 2.11 Steering gear trials before ship goes at sea.

Every time when the ship goes at sea the steering gear should be checked and tested according to the Test Program Schedule (att. 23).

## 3. Maintenance instructions.

All elements of steering gear should be always kept in a good condition and cleanness. Not painted surfaces should be periodically lubricated by machine or hydraulic oil. Noticed contamination, marks of corrosion and losses in protecting films should be removed as soon as possible. All scratches on pistons surface disqualify the product from further exploitation. In accordance with steering gear manufacturer damaged pistons should be replaced together with seals.

## 3.1 Lubrication.

- rudder must be put from side to side every 24 hours in order to lubricate piston-rods in hydraulic cylinders by an oil film
- bearings and joints of rudder piston should be lubricated by oil or machine grease every week (acc. to the construction)

## 3.2 Filter cleaning.

Filter contamination is signaled by lamps placed on filter sensor and on the signaling tables in ECR and wheelhouse.

Filtration inserts of filters, placed in circulating tanks, should be exchanged for new ones when signal of filter contamination occurs.

It is allowed to clean filtration inserts once by rinsing them in kerosene and blowing it by compressed air (opposite to oil flow direction).

## 3.3 Exchange of oil in hydraulic system of steering gear.

### 3.3.1 Hydraulic oils.

Hydraulic oils and their characteristics are given in it. 2.1. Applied oil must fulfill conditions given in Technical Data [TD-01/71128-00.00](#).

### 3.3.2 Periodical oil changes.

For the first time oil should be changed after 3 months of steering gear exploitation.

After that period it is recommended to change oil every 4 years. As the period of oil change depends on the degree of its contamination, so once a year technical parameters of oil should be checked and in case of departure from characteristics for the given class such oil should be exchange. This period can be extended until oil fulfill purity class and viscosity index.

### 3.3.3 Oil change instruction.

Oil exchange procedure should be carried out for each cylinder system. It can be realized by separating the circuit by valves S1, S2 and emptying the spare tank. Cleaning the interior of the tank is recommended before filling up with the fresh oil.

Subsequently proceed as follows:

- remove used oil from one chamber through a probe in the bottom of the tank
- disengage connections of the corresponding cylinder

- turn on the second pump unit and move the rudder from side to side. This will cause complete emptying of the cylinder
- exchange filtration inserts of filters
- clean emptied chamber of the circulation tank
- fill the system from the spare tank
- vent and rinse the hydraulic system – see item 2.2, 2.3
- fill up circulating tanks and spare tank to  $V_{\max}$
- repeat procedure for second cylinder

### 3.4 Checking oil level in tanks.

At least once a week oil level in circulating and spare tanks should be checked and its loss should be filled up to  $V_{\max}$ . To check oil level in both circulating and spare tanks you need to use bayonet fluid level indicator screwed into upper covers of tank.

### 3.5 Maintenance at the producer.

The steering gear is preserved at the producer for the storage period of 6 months beginning from the date of delivery.

All inlet and outlet holes of units and elements for hydraulics are plugged.

## 4. Repair instructions.

### 4.1 General recommendations.

Current repairs should be made after observation of damages or irregular work of the steering gear. Typical cases of irregular work and its cause are given in item 2.10.

It is recommended to make the inspection of actuator unit acc. to Technical Operation Documentation. The spare parts acc. to List of Spare Parts [WZ-01/71128-00.00](#) (att. 24) for repair purposes are delivered together with steering gear. After repair, the steering gear should be filled with fresh oil acc. to it. 2.2, vented and rinsed acc. to it. 2.3, adjusted acc. to it. 4.2. and tested acc. to Test Program [TP-01/71128-00.00](#) (att. 23).

It is recommended that repairs, adjustment and tests of the steering gear should be carried out by service or under the supervision of Hydroster service engineer.

## 4.2 After repair adjustments.

If it is necessary, the following adjustment should be carried out:

### 4.2.1 Adjustment of safety valves of pumps and cylinders.

During adjustment the hydraulic diagram [HH-01/71128-00.00](#) (att. 1) and technical data [TD-01/71128-00.00](#) (att. 3) should be used. The adjustment should be carried out separately for each pump and for hydraulic cylinders belonging to them, after adjusting time of rudder putting over while valves S1, S2 are closed and by-pass valves are opened.

- set limit switches in feed-back transmitters for such angle as the rudder can rest on deck stoppers
- screw-in home the spindle in valve block fitted on the cylinder of the given pump
- block safety valves of hydraulic cylinder, that means screw-in home adjusting spindles
- using emergency control at full deflection of lever, rest the rudder on deck stoppers and set up pressure of pump in accordance with Technical Data [TD-01/71128-00.00](#) (att. 3)
- after adjustment of pump valves, make one by one adjustment of safety valves in hydraulic cylinders. Maintaining pressure of pumps safety valve, screw-in adjusting spindle of safety valve for hydraulic cylinder, up to the moment when pressure begins to fall. In such way the safety valve for cylinder is being adjusted
- put over the rudder to opposite side and adjust second valve of the corresponding cylinder
- in the same way adjust valves of both second pump unit and cylinder

### 4.2.2 Middle rudder position adjustment $\alpha = 0^\circ$ .

The adjustment should be carried out for each pump separately. The middle position is set by adjusting length of flexible connector of feed-back transmitter. Technical documentation of remote control system should be followed as well

### 4.2.3 Adjustment of rudder deflection $\alpha = \pm 60^\circ$ .

The adjustment is made by relevant setting of limit switches in the remote control system transmitter of feed-back unit. Technical documentation of remote control unit should be followed.

## 4.3 Checking of external tightness.

External tightness should be checked during adjustment of safety valves. In order to check tightness pressure should be raised up, three times in a row to  $p_{\max} + 1\text{MPa}$  and kept for at least 5 seconds. Tests to be carried out for each pump separately at rudder deflection on PS and STB.

External leakage is impermissible.

## 4.4 Trials of steering gear after repairs.

When repair and adjustment are finished, the steering gear trials should be carried out according to Test Program [TP-01/71128-00.00](#) (att. 23).

The positive result of trials has to be confirmed and signed.

## 5. Attachments.

Att 1.	Hydraulic diagram of steering gear.	<a href="#">HH-01/71128-00.00</a>
Att 2.	Schedule of elements of steering gear.	<a href="#">WE-01/71128-00.00</a>
Att 3.	Technical data of steering gear.	<a href="#">TD-01/71128-00.00</a>
Att 4.	Tiller.	<a href="#">62131-00.00/00-00</a>
Att 5.	Schedule of elements of tiller.	<a href="#">WE-01/62131-00.00</a>
Att 6.	Hydraulic cylinder.	<a href="#">21162-00.00/00-00</a>
Att 7.	Schedule of elements of hydraulic cylinder.	<a href="#">WE-01/21162-00.00</a>
Att 8.	Valve block of hydraulic cylinder.	<a href="#">44219-00.00/00-00</a>
Att 9.	Schedule of elements of cylinder's valve block.	<a href="#">WE-01/44219-00.00</a>
Att 10.	Cylinder holder.	<a href="#">27131-10.00/00-00</a>
Att 11.	Power unit.	<a href="#">27131-00.00/00-00</a>
Att 12.	Schedule of elements of power unit.	<a href="#">WE-01/27131-00.00</a>
Att 13.	Instruction table.	<a href="#">71128-00.00/01-00</a>
Att 14.	Drive unit.	<a href="#">35165-00.00/00-00</a>
Att 15.	Schedule of elements of drive unit.	<a href="#">WE-01/35165-00.00</a>
Att 16.	Pump unit.	<a href="#">32132-00.00/00-00</a>
Att 17.	Schedule of elements of pump unit.	<a href="#">WE-01/32132-00.00</a>
Att 18.	Valve block.	<a href="#">44218-00.00/00-01</a>
Att 19.	Schedule of elements of valve block.	<a href="#">WE-01/44218-00.00/01</a>

Att 20.	Plate.	71711-03.07/02-00
Att 21.	Plate.	71711-03.07/03-00
Att 22.	Rinsing of hydraulic system.	DR-10/71128-00.00
Att 23.	Test program.	TP-01/71128-00.00
Att 23.1	Test program of the steering gear.	TP-02/71128-00.00
Att 23.2	Test program - drive and signaling	TP-60/71128-00.00
Att 23.3	Technical description and program of hydraulics lock.	TO/TP-01/71128-00.00
Att 23.3.1	Signaling of hydraulics lock.	DR-01/71128-00.00
Att 24.	List of spare parts.	WZ-01/71128-00.00
Att 24.1	Spare parts of power unit.	WZ-01/27131-00.00
Att 24.1.1	Spare parts of hydraulic cylinders.	WZ-01/21162-00.00
Att 24.1.2	Spare parts of valve block.	WZ-01/44219-00.00
Att 24.2	Spare parts of drive unit.	WZ-01/35165-00.00
Att 24.2.1	Spare parts of pump unit.	WZ-01/32132-00.00
Att 24.2.2	Spare parts of valve block.	WZ-01/44218-00.00/01